

COAST SURVEY.

LETTER

FROM

THE SECRETARY OF THE TREASURY,

TRANSMITTING

*A report of the late F. R. Hassler, relative to the operations and condition of the coast survey.*

JANUARY 31, 1844.

Read, and laid upon the table.

TREASURY DEPARTMENT,

January 29, 1844.

SIR: I have the honor to submit, herewith, the report of the late F. R. Hassler, upon the operations and condition of the coast survey. It will be seen that very considerable progress has been made in the work, and that several important charts are in such a state of forwardness that their speedy publication may be expected.

As the report now transmitted was made before that of the principal assistant, Mr. James Furguson, was received in relation to his operations south of the Chesapeake, referred to by Mr. Hassler, the account of these operations is also herewith transmitted.

Very respectfully, your obedient servant,

J. C. SPENCER,

*Secretary of the Treasury.*

Hon. J. W. JONES,

*Speaker of the House of Representatives.*

*Report of F. R. Hassler, as superintendent of the survey of the coast of the United States, and the construction of standards of weights and measures, upon the progress of the coast-survey works in 1843.*

My last report to the Treasury Department, of the 17th November, 1842, has given the full standing of the work at that time, together with all such informations as would clear up and answer the questions which had been raised upon that work in general, and communicated to me.

The first task to go through, after the parties of the coast survey had left the field, was the attendance of myself, and of several assistants, upon the committee of investigation, established by Congress February 19, 1842, to answer the questions presented by the different members of the committee, which appeared to have been all fully satisfactory as to the administration, conduct, and mathematical principles upon which the work had been conducted. But the committee members not agreeing upon a report to make to Congress, they proposed ultimately the establishment of a temporary board, consisting of some assistants and officers of the corps of topographical engineers, to discuss the plan of operation and organization.

In the mean time Congress having changed the beginning of the fiscal year, thence the consequent terms of the appropriation, and the first half year's appropriation having been withheld, the expenses to keep the work in its ordinary train until July 1st, beginning of the new appropriation, were nearly fully supplied by the funds on hand from the last appropriation. The management of that part having heretofore always been so as to secure the means of setting the work in activity in the spring, whenever, by the long sessions of Congress, the appropriation should be made later than the opening of the season for field-work required funds; it reached so near, that, if one of the vessels of the hydrographic parties, being no more necessary, the amount of its value had become disposable, the balance of expenses might have been fully covered up to the period when the new appropriation became available.

The board in its deliberations declared, as the first principle on the outset, the plan of the work originally proposed by me in 1807, 1816, and 1832, as fundamental and constant rule for the work, such as it had at all epochs allied the approbation of the first men of science in the country; nor could this be otherwise, consistently with the existence of the work, the scientific character and principles of it being indispensable to the success of the work and of its acceleration. Mathematics and nature cannot be commanded; their laws are imperious above all command; thence, in all such works as require their application, the merit consists in the invention of the best and proper methods to a given aim. My methods have been equally approved, and successfully applied.

But a variety of alterations in detail parts were made, which have been considered as not specially given in charge to that board, the majority of the members having by their situations, naturally, not sufficient detailed knowledge of the work in all its parts and connexions. How far this influence may go, is left to the further experience to be made, under the more *calculated* regulation of the Treasury Department, now in activity upon it since a few months only.

My remarks upon the report of the board, and the Treasury Department regulations, handed in at that time, have explained this fuller, and do not belong here to repeat.

The field-works of the secondary triangulations, the plane-tables, and the two hydrographical parties, as well as the main triangulation, were, however, put into activity, each as soon as possible, and not for any remarkable time delayed behind the habitual time of the season.

The following was the distribution of the works, and their results as far as hitherto known; to which I must only add the remark, that the

season not having been fully closed yet, more results may still be expected in some parts.

The main triangulation having reached a point of considerable importance—namely, the place of division of the triangles easterly to the mouth of the Delaware, and westerly to extend over the Chesapeake—it was necessary to arrive with longer lines appropriated to both these directions, reaching over the largest part of the Delaware valley, over water and woods, which occasion great terrestrial refraction; it became necessary to observe upon the stations from higher stands, then may be in use, when abrupt heights can be selected, and also to elevate the heliotropes in still greater proportion over the too variable lower refraction.

This very circumstance of large terrestrial refraction, with its nearly regular variation at different times of the day, which has been the subject of special scientific investigations, I have made constant use of now two seasons, to overcome the difficulties which would otherwise prevent the establishing triangles of the proper size and proportion in the present locality of the main triangulation. *Triangular* scaffolds, solidly braced, from twelve to thirty feet high, are erected over the station points, having the central point corresponding with the centre of the station, upon which the centre of the heliotrope is placed, to direct to the station of observation.

The heliotropic signals alone make this triangulation possible, as no other object, not reflecting the rays of the sun with brilliancy, is visible at these distances in that atmosphere; they are seen in an atmosphere so hazy as to render the hill itself invisible. The permanency of this reflection is necessary for the advancement of the work; the reflecting tin cone signals, which I invented, and used at first in the work over Long Island sound, being not permanent enough in these regions.

The stations in New Jersey, directly engaged in the scheme of the triangulation, which shall join the two bays of Delaware and Chesapeake, have been executed, though under very great impediments and delay, from the well-known eminently rainy season of this year. Those which lie in the States of Pennsylvania, Delaware, and Maryland, are now in work; but before the station of Meeting-house hill can be completed, I shall have to make special reconnoissances southerly, to procure points corresponding properly to an accurate system for the future work.

I had always thought desirable to establish some work south of the Chesapeake as soon as admissible. I had therefore, myself, proposed in the board, to establish some preliminary works this season, and while for the northern parts the execution of the maps in drawing, engraving, and printing were carried on, so as to present fully executed works. The union of these two measures—of surveying in one section; and printing the work from the other section—which would in time alternate, appeared to me best adapted to the general interest of the country in the work of the coast survey, at the same time that it was executable within the limits of the hitherto habitual appropriation; in that idea I had been approved by several Presidents.

An assistant was therefore directed to the southern part of the country, to begin the preliminary reconnoissances and other operations; but fear of sickness of the southern regions determined him to continue the verification, and the further laying out of a few secondary triangles in the Chesapeake during the summer, and to defer the works in the south till beginning of October. The account of his operations is still to be expected.

This operation is the beginning of the changing of the field-works in the south, from the summer to the winter, which I have quoted in my last report as natural consequences of the locality and the climate; it is therefore expected, and proper, that the party shall stay out all winter and next spring, which will be fully required to present some proper systematic beginning.

The second party of secondary triangulation has been at the east end of Long Island, and upon the Rhode Island shore, engaged principally in taking up some of the stations determined by previous works, with a view to further continuance. But, as well this part of the works, as the preliminary triangles in the Chesapeake made last summer, cannot be applied immediately as bases to the topographical and hydrographical detail works of the survey, on account of their greater distance from the main triangulation and the necessity of nearer details. Two other secondary triangulations—the one from the headwaters of the Delaware to Philadelphia, and the other from Philadelphia to the junction of a similar one made below last year—are all equally intended to extend the previous secondary triangles into the details which the localities required. They have well succeeded under two other assistants.

I am obliged to observe, that the reliance upon a tertiary triangulation, which has been occasioned by the insufficiency of the secondary triangulation, never laid in the plan of the work, as it leads evidently to considerable loss of time. The secondary triangulation, *properly conducted*, shall furnish sufficient points for the topography.

The plane-table works in these districts are now going on as rapidly as they can be carried on, to furnish to the hydrographical party in the Delaware the means to finish its work this season.

The plane-table party engaged at the east shore of the Delaware has finished its task; it has been directed to the assistance of the one just stated, below Philadelphia, to secure the completion of its task.

Another plane-table party has been engaged in the part of the country lying between the Delaware and the Chesapeake bays, necessary for the connexion of the work to an unity. This work has given occasion to determine approximately the latitude and longitude of the northernmost point of the Mason and Dixon meridian, with relation to the coast survey. It is intended to bring a secondary triangle to bear upon that point, for its closer junction with the coast-survey work.

The hydrographic party engaged upon the Delaware bay and river is expected to continue its operations, without interruption or regard to the season, up to the head of the tide; the parts of the bay and the main river below Fort Mifflin being already completed.

The triangulation of the coast survey having, as it seems, for the *first time*, determined the breadth of the river, and the proper situation of even the principal points and light-houses on the river, very great difference has been discovered with the best older maps. The publication of the results of the coast survey will therefore, in this case, like in the survey of the New York harbor, prove to furnish a very valuable acquisition for the navigation. The directions for sailing in the river, which are (I hope) now making, will show the full use to be made of it.

The remainder of the outside shore soundings along New Jersey, from Barnegat inlet to Cape May, is reported as completed; so that from that side remain only the inside of that bay, and the two Egg Harbor bays,

and the nearer details of the inlets, to be sounded. Account is just now received that the shoals at sea, and out of sight of land, opposite to that shore, have been investigated, as I had requested.

For both the hydrographical parties, stations of observations, of magnetic bearings, of the tides, and of all the meteorological observations, have been simultaneously established for the inner party at Cape Henlopen light-house, and for the outer party at Cape May light-house, the results of which shall furnish valuable guides for the shipping in entering the Delaware bay. It is expected that all the final reductions of the naval part of the work, into charts, will be finished this winter in the office. The bad weather with which the after season introduces itself, may, however, refuse the realization of some of the hopes that were placed upon it, for the small completions of works.

To continue the systematic order of bringing the results of the coast survey into practical utility, the maps of the neighborhood of the beginning of the work have been continued to be reduced to the proper scale for publication, as had been begun *last* years, namely: New York bay and harbor, Long Island sound, and part of the southern shore of Long Island. The Delaware bay and river will be taken in hand, with the same view, as soon as the survey is completed. The outside shore of New Jersey must be delayed until some further junctions of it are executed by a triangulation across New Jersey.

Of the maps so reduced for publication, there have *been engraved* the following *eight sheets*, viz:

1. A map (in one large sheet) of the harbor of New York, with its approaches, from as far outside as east of Rockaway, in the east, and below Long branch, at the south, until to the middle of New York, and to outside of Hellgate, *with all its inner bays*. This map will be finished engraving, so that it can be given to the public, this winter. It contains all the soundings necessary for navigation.

2. The detail map of New York, upon a larger scale, viz:  $\frac{1}{300000}$ , containing all the minuter topography of New York, the port, its entrances, all its approaches, and the neighborhood, which will cover eight sheets, or plates, of which six are in a considerable state of forwardness.

3. The first sheet of the map of Long Island southern shore, which is in a very advanced state.

4. I might quote here, as results already given to the public, the maps delivered upon calls of Congress, some of which have been published; but the memory of them seems unfortunately to be obliterated, when results of the coast survey are called for. They were eight in number in December, 1841. They are, however, no less results of that work, which have cost time and labor, and have come into public utility at an early time, by which the ready progress of the work became always evident.

Engraving, particularly of maps, where mathematical accuracy is required, cannot go on rapidly like other fancy engraving; the task is arduous and fatiguing; and the very minute care to be taken, consumes, of course, a proportional length of time. This part of the work has, in general, been continued assiduously, with the same means and system as last year.

It appears here to be the proper time and place to call forth the regulation of the mode in which the maps resulting from the works of the coast survey shall be brought into the public in a proper manner, that will se-

cure both the property of the nation in the work, and the public confidence, which they must command by the authority with which they are presented, as well as by their well-known scientific value and accuracy. It cannot be otherwise but fully evident that the Government has the duty to secure both the above aims. I would take the liberty to suggest, as a secure means to these aims:

1st. That the final maps, when ready to come into the public, be signed by the superintendent of the work, and stamped with the seal of the office.

2d. That then there be always a number of copies distributed to the collectors of the seaports, by them to be sold to any applicant, at a certain fixed price, which shall be marked upon the stamp, for each individual map.

3d. That the price of the maps shall be determined so as to cover the expense of printing and of the paper with certainty, without any ulterior benefit, in order to make them easy accessible, to seamen particularly, and to prevent contrefaction, (as they could never be imitated at that price.)

To secure the best impressions of the maps, and at the same time secure the plates from deterioration, it was necessary to procure an appropriate press, and the other necessary implements, as a large *paper* press, &c.: this has been done. A well-constructed copper-plate press, with a paper roller, and with new, well-calculated arrangements, has been put up in the office of the coast survey; and also an appropriate paper press; they are ready for use, and have served already for proof impressions, such as are always needed to keep account of the progress of the engraving.

The authorization of the Treasury Department to procure paper purposely made, and appropriate for the impression of the maps, has also been executed under the most favorable auspices. The paper is announced to arrive in due time for the actual use in the final printing.

These statements will show that full preparations are everywhere made to cause the coast survey results to step properly into the public. To give them their proper standing, their final execution in drawing, engraving, and printing, must necessarily bear the same stamp of science, care, and assiduity, which has been put in the direct mathematical part of the work, from the elements up to the determination of all the results that are to be presented to the public. No part of the work can leave the eye which has watched over its beginning.

To allow to each of the works the indispensable proper time, is one of the principal requisites; pressing and hurry would actually delay the work; steady, reflected work, will alone produce the proper and creditable results in the shortest time possible. The laws of nature, which dictate paramount in all such works, cannot be set aside with impunity. All these principles have always been worked upon in the whole process of the coast-survey work, with steady assiduity. The results are therefore following with the proper celerity, and could actually not be more accelerated by any other means.

With respect to the appropriation which it will be proper to propose to Congress for the next year, I believe that more than the (of late years) usual amount of \$100,000 could hardly be obtainable, and that the arrangements of the work must be made to fit within these limits; for this

particular I wish I may be allowed to state the proper arrangement, at the time when the next year's distribution of the work will have to be decided upon. One of the main points will, of course, be to keep within the limits of the appropriation which will remain on hand at that period; for, in any case of overreaching our means, the interruption for want of funds would fall in the time of the most active work; thence of the greatest and most pressing expenses, and cause the most deleterious interruptions.

F. R. HASSLER.

STATION BETHEL, PENNSYLVANIA,

November 12, 1843.

WASHINGTON, January 10, 1844.

SIR: The observations at the station of Bethel were completed on the 13th of December, and on the day following I sent the great theodolite to the room occupied by Lieutenant Blake, in the Exchange of Philadelphia. This disposition of it was made, instead of sending it to the mint, for the reason that I was then uncertain whether an apartment could be appropriated for it in that building. I have since heard from the director that he has a room to spare for the purpose, and which he will place at our disposition at any time we may wish. Of the other apparatus in use at Bethel, part was sent to Washington, and a part placed in the public store of the custom-house at Wilmington, as the most secure depository near the points of the survey where they are next to be used. Inventories have been kept by Mr. Hein, and are now in the office of the survey at Washington.

The occupation of the station of Bethel interfered, as I have already apprized you, with the reports of the reconnoissances of the southern survey. They are now all complete, and the following papers have to-day been delivered at the office of the survey:

(1.) Two journals of observations and results of the station of Bethel—one, the original, kept at the station by Mr. Hein; the other, a copy.

(2.) A journal of Mr. Neilson of the reconnoissance of Albemarle sound; in which the most appropriate location of a base for the southern survey has been found. This journal contains detailed topographical sketches of the coast.

(3.) Accompanying this, are two maps—one, of the site of the base; and the other, a scheme of the triangulation in Albemarle sound.

(4.) A map by Mr. Cutts, on a scale of  $\frac{1}{400000}$ , exhibiting the whole of the reconnoissance from Cape Henry to Cape Lookout. On this are indicated the lines which must be cut for the triangulation, and the visibilities of which we are now certain, in the broad parts of the Pamlico sound.

(5.) A book of signals, (C, 3,) found in the instrument box at Bethel.

(6.) L. M. Z—3, containing ordinates of points in the Delaware and Chesapeake bays, calculated in 1843.

In the reconnoissance of the Pamlico sound, which was executed by myself, I have deemed it unnecessary to make any detailed description of the points which may come into the triangulation. They are indicated with sufficient distinctness on the map, (No. 4.) The distances from point to point, in the broader parts of the sound, have, in general, been deter-

mined by the run of the vessel in which we sailed. As a general description, however, I may say, that the shores on both sides of the sound are low—those on the west side wooded and swampy. There is, therefore, some doubt in the broader parts of the sound, whether (without waiting for particular states of the atmosphere) it may not be impossible to see from one shore to the other, without rather expensive constructions. States of the atmosphere sufficiently favorable for the most distant observations required in the survey, are said often to occur in these waters. On the 16th of November last, the low banks above Ocracoke were seen distinctly from Swan quarter nearly the whole afternoon; the distance being certainly greater than any other to be expected in the triangulation. Without, however, trusting to such favorable circumstances, there are shoal places—even bare rocks at distances of from two to seven miles from the shores—which would afford sufficient security to an observer or a signal, except in the heaviest gales.

I have mentioned in a preceding communication to the department, that, in regard to health, the months to be used in this part of the survey are October, November, and from February till June. It will therefore be essential, in furthering this part of the work, that arrangements be made at an early date.

The journals and maps enumerated, and already delivered, will, it is believed, give all the preliminaries necessary in this part of the survey.

I am, sir, very respectfully, your obedient servant,

J. FERGUSON.

HON. JOHN C. SPENCER,

*Secretary of the Treasury.*